Aerodynamic Performance of Backward Centrifugal Fan with Rectangular Casing

Graduate School of Engineering, Nagasaki University
WAR WAR MIN SWE

Small size centrifugal fan is sometimes used not with the conventional scroll casing but with the complicated casing. The section geometry of the casing varies complicatedly in circumference location and sometimes has the very large outlet. In this research, it is cleared the influence of the circumferential variation of the casing geometry to the performance and flow characteristics of the fan. The performance of fan was examined with experiments. And the performance and flow characteristics analyses are carried out with computational simulations. At first, the fan performance and the flow characteristics with complex geometry casing, rectangular casing, are examined with comparing to the conventional scroll casing. The flow characteristics and energy loss are analyzed for the casings. The air flow in centrifugal fan is highly complex with the interaction between the impeller and casing. But the performance of fan with rectangular casing is improved over the design flow rate compared to that of scroll casing fan. Even though, the complex geometry of rectangular casing, the energy loss of the rectangular casing fan is smaller than the scroll casing fan. The energy loss near the outlet of the casing (tongue region in duct) is large in scroll casing. In the rectangular casing, the large outlet section of the casing improved the casing performance at large flow rate. Next, it is analyzed the influence of the circumferential variation of casing geometry to the simulation results. The steady and unsteady simulation are compared for rectangular casing fan that the flow pattern is varied in circumference. It is clear that the flow behavior in the passage of the impeller is quite different in the steady simulation to unsteady one. When the flow separation occurs in the blade passage, the flow separation becomes larger in steady simulation compared to that in unsteady simulation. And the variation of the flow pattern in circumferences direction becomes large in steady simulation. But, when the flow separation doesn't occur in blade passage, the difference between the steady and unsteady simulation is comparatively small. When the circumferential variation of the fan casing is large, it is pointed out that the steady flow simulation is not suitable, but the unsteady flow simulation is suitable.